JSC Reduced Gravity Program User's Guide

Aircraft Operations Division

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Mission Statement

To provide a world-class, reduced gravity research platform that emphasizes user compatibility, quality reduced gravity levels, and a customer-oriented support organization.

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1.0 INTRODUCTION

The Reduced Gravity Program, operated by the National Aeronautics and Space Administration (NASA), Lyndon B. Johnson Space Center (JSC) in Houston, Texas, provides a "weightless" environment, similar to the environment of space flight. This is done on a cost reimbursable basis for research and training purposes. For those researchers who have NASA research grants, are being funded by NASA or another government agency, have a Memorandum of Understanding (MOU), or Space Act Agreements with NASA, the cost reimbursable basis provides the mechanism for flying an experiment aboard the C-9B.

The reduced gravity environment is achieved by flying a modified Boeing C-9B turbo fan aircraft through a series of parabolic maneuvers. This results in short periods of less than one "g" acceleration. The lengths of these reduced gravity periods depend on the "g" level required.

Negative-g to	1/10 max	15 seconds
Zero-g	0-g	23 seconds
Lunar-g	1/6-g (.16)	30 seconds
Martian-g	1/3 g (.38)	40 seconds

These maneuvers may be flown consecutively (i.e., roller coaster fashion) or separated by enough time to alter the test setup.

Normal missions, lasting approximately two hours, consist of 40 parabolic maneuvers, and originate and terminate at Ellington Field in Houston, Texas. Changes to the normal mission profile can be made to ensure more efficient test operations.

Requests for operations away from Ellington Field will be considered on an individual basis addressing the benefit to NASA, fiscal soundness, scientific merit, airspace accessibility, and overall Reduced Gravity Program schedule impact.

The C-9B aircraft test area is equipped with electrical power, compressed gas, an overboard vent, accelerometer data, and photo lights. NASA JSC can provide photographers for still photography and video coverage. An S-band video downlink with two-way audio capability may also be requested. Workspace is available on the ground for buildup and checkout of test equipment to ensure its operation before installation in the airplane.

1.1 Purpose

The purpose of this user's guide is to provide a guideline for existing and potential users of the Reduced Gravity Program. This document details user and test equipment

requirements and provides information on pre-flight, post-flight, and in-flight test operations.

1.2 Scope

This work instruction applies to all users and potential users of the JSC Reduced Gravity Program.

1.3 References

American National Standards Institute Z-136.1 Safe Use of Lasers

AOD 33895, Visitor's Guide NASA JSC RGO

AOD 33896, Test Equipment Data Package Requirement and Guidelines NASA JSC RGO

AOD 33897, Experiment Design Requirements and Guidelines NASA 932 C-9B

AOD 33912, Interface Control Document NASA 932 C-9B

AOD Form 72, C-9B Quick Reference Data Sheet

AOD Form 150, Human Research Master Protocol

AOD Form 151, NASA/JSC Human Research Informed Consent

AOD Form 1492, Mishap Notification

Deutsche-Luft-und Raumfahrt

Federal Standard W-C-596/90

Federal Standard W-C-596/91

JPR-1710.13C, JSC Requirements and Handbook for Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems

JPG-1700.1, JSC Safety and Health Handbook

JSC-17773, Preparing Hazard Analyses for JSC Ground Operations

JSC-20483, JSC Institutional Review Board – Guidelines For Investigators Proposing Human Research For Space Flight And Related Investigations

JSC Form 473A, NASA JSC Badge Request Form

JSC Form 8500, Report of Medical Examination

JSC Form 902, Customer Feedback

National Electrical Manufacturers Association (NEMA) L5-30P

NS-STO-CH01, General Hazard Identification Checklist

Standard Form 88, Report of Medical Examination

Standard Form 93, Report of Medical History

1.4 List of Acronyms

AOD	Aircraft Operations Division
DOD	Department of Defense
FAA	Federal Aviation Administration
FCOD	Flight Crew Operations Directorate
GRC	Glenn Research Center
IRB	Institutional Review Board
JSC	Johnson Space Center
MOU	Memorandum of Understanding
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
RGO	Reduced Gravity Office
SCTF	Sonny Carter Training Facility
TEDP	Test Equipment Data Package
TRR	Test Readiness Review

1.5 Test Equipment Data Package

Test Equipment Data Packages (TEDP) are required for all experiments requesting flight time on the C-9B. This package is required to provide detailed documentation of an experiment by addressing all aspects of its design. Researchers shall submit an electronic copy of this document to the Reduced Gravity Office (RGO) **six weeks** prior to flight. The electronic copy may be submitted by email, FTP, or recordable media. If unable to submit an electronic copy, researchers shall submit **seven** hard copies of this document to the RGO **six weeks** prior to flight. The document must be 100 percent complete in order to initiate its review. Failure to provide a complete and accurate TEDP **six weeks** prior to flight may result in flight disqualification. Any experiment deemed unsafe or not clearly defined through review of a TEDP may also result in flight disqualification or delays. See AOD 33896, TEDP Requirement and Guidelines NASA JSC RGO Section 2 or instructions on how to prepare a TEDP. For those researchers who wish to submit the TEDP electronically, contact the RGO for software requirements.

1.6 Flight Crew

The flight crew for the C-9B is typically made up of a Pilot in Command, Co-Pilot, Flight Engineer, and two Test Directors. When required, a Flight Surgeon, and Video and/or Still photographers will join the flight crew as well. The Pilot in Command flies the aircraft during takeoff, landing, and during the parabolas. The Pilot in Command is responsible for the aircraft and those researchers assigned to the flight; therefore, he/she has the final say on whether or not the flight will proceed.

The Co-Pilot is responsible for all communications with the air traffic control center and also flies the aircraft when the Pilot in Command is unable. During the parabola, the Co-Pilot is responsible for navigation of the aircraft and ensures the aircraft stays within the restricted airspace provided by air traffic control.

The Flight Engineer is responsible for monitoring aircraft systems and assisting the pilots during any emergency situations. The Flight Engineer also keeps track of the parabola count and reconfigures the offset of the reduced gravity display in the cockpit for parabolas.

The Test Directors are responsible for all of the activities in the cabin area during both ground and flight operations. The primary job of the Test Directors is SAFETY. During ground phase preparations, the Test Directors lead the Test Readiness Review (TRR) and direct the loading of the experiments onto the aircraft. During the loading, the Test Directors have the final say regarding placement of the experiments, and where and how experiment hardware is integrated into the aircraft and operations.

During flight operations, the Lead Test Director is in charge of all cabin activities. At any time during the flight, the Test Directors can terminate any experiment they feel is unsafe to continue. The Test Directors communicate with the pilots via the intercom system.

Throughout the flight, the Test Directors may help any researcher who is in need of assistance. This may include helping with an experiment or helping a researcher that is having difficulty with motion sickness.

NOTE

Test Director's primary duties may supercede "helping" researchers with nominal operation.

In the event of an emergency during flight, the Lead Test Director is in charge of all cabin activity and will inform the Pilot in Command of the nature and status of the emergency.

1.7 Photographic and Videographic Support

1.7.1 Photographic Support

NASA JSC photographers provide photographic support as required, for the purpose of test documentation or analysis. NASA photographic services may be arranged by including a request in the Test Equipment Data Package submitted prior to flight. Photographic support includes:

1. Camera, lights, and other photographic equipment
2. Expendable supplies (film, etc.)
3. Image Processing and finishing (printing and writing of CD-ROMs)
4. Viewing and analysis facilities

Four categories of photographic services are available:

1. Still Photography—Documentary

   Documentary still photography is performed using high-resolution digital cameras. Customers can view the still images after the flight. Selected images from the week's flight will be placed on the Internet for viewing, downloading or printing by the customer.

   Digital 8 inch x 10 inch color prints or CD-ROMs will be available in limited quantities based on customer requests and approval from the RGO Office.

2. Still Photography—Scientific

   The photographers utilize special equipment for scientific or public relations photography as requested by the user. Hasselblad medium format and Nikon 35mm cameras can be equipped to handle a variety of photographic situations.

3. Motion Picture—Documentary

   Documentary motion pictures are filmed in 16mm format, either with or without synchronous sound. The JSC Photography Group is able to cover a large range of documentary situations, from simple "available light" situations to "multiple light" set-ups.

   NASA/JSC does not provide processing and prints of 16mm motion picture film.

4. Motion Picture—Instrumentation (Scientific)

   Motion picture photographic instrumentation captures information which may not be accessible, due to high speed or other factors, to the human visual system or to other instrumentation.

   The JSC Photography Group uses high-speed or time-lapse motion picture cameras for most instrumentation applications. These cameras provide the required compression or expansion of time so that experimental data can be recorded in a form which is readily accessible.

   The photographers are available (usually in Building 8 at JSC) to set viewing times, arrange viewing facilities or provide other assistance in analyzing the photographic data.

1.7.2 Television Support

NASA JSC television personnel provide support, as required, for the purpose of test documentation or analysis. Users may arrange for television imaging-capture support by including a request for NASA television service in the Test Equipment Data Package.

Television support personnel and equipment for each flight is based on particular test requirements. Equipment can include:

- (MiniDV, H-8MM, VHS, and SVHS) video recorders/camcorders
- Videotape stock for required equipment
- Battery and AC operated color monitors for in-flight viewing

S-band downlink is now available at an additional cost to requesting researchers. Also, at present, capability for single video channel, single downlink and UHF voice uplink is available. Interested researchers must contact the RGO for cost and scheduling information. Researchers planning to use the S-band downlink must contact the RGO at least **six weeks** prior to flight to find out the availability of the S-band downlink. Due to Shuttle and International Space Station requirements, the S-band downlink capability is not always available for C-9B operations. Other television capabilities are also available, and are described in the following paragraphs:

1. Documentation

   Television coverage for documentation purposes can be provided in any of the formats indicated above if requested well in advance of flight. Generally, existing light levels are adequate to support television documentation. Additional battery operated lights are available upon advance request.

2. Instrumentation or Scientific

   Television imaging of specific instruments or experiment processes, not easily discernible by the human eye, can be captured in standard speed color video with slow-motion playback.

3. Video Copies

   Original camera videotape is kept on file in the RGO with the user receiving one copy. With advanced notice, copies of the videotape can be made over night, if necessary. For all other requests for copies of videos, the researcher must submit a Zero-G Video Dub Request and e-mail it to the Reduced Gravity Office. Windowed copies (with the time code printed in the picture) can be generated (if the original tape is mastered to a higher format with time code capabilities.)

4. Special Services

   In-flight recordings can be prearranged for viewing after the flight at the RGO.

   Full viewing facilities are also available at the Imagery Services Branch facilities in Building 8 at JSC. Editing capabilities also exist at JSC, and arrangements for such support should be made well in advance.

   With advance arrangement, video, still prints (5 x 7 inch color prints) can be acquired after the flight through the Imagery Services group.

Special requirements for each flight such as: wide angle lenses, specially mounted cameras on test objects, or multiple television cameras at different viewing angles can be accommodated if arranged well in advance.

1.8 Flight Medicine

1.8.1 Motion Sickness Medication

Some researchers aboard the C-9B aircraft experience motion sickness during the flight. The percentage of those with this condition is about 60 percent. Symptoms include pallor, increased perspiration, nausea, and vomiting. In an attempt to avoid this syndrome, various medications have been used for many years. However, no one medicine has been perfect in preventing this condition. *Taking* the medication does not

guarantee one will not become ill and, conversely, *not taking* the medication does not mean one will automatically become ill. Individuals must decide for themselves whether or not to take any medication. It is not mandatory to take any medication.

If researchers wish, NASA will provide some medication to them for each flight. Arrangements can be made through the RGO to have researchers pick up the medication prior to flight. Researchers taking **any** sort of medication should consult with the NASA physicians associated with the flight **prior to boarding** the aircraft (preferably 24 hours prior). If researchers are taking any medication for any condition, they should talk with the NASA physician if they plan to take the anti-motion sickness medicines offered because of possible drug interactions and adverse reactions. This caveat includes over-the-counter medications and "pills and potions" from a health-food source or nutrition center.

Medications provided by NASA typically wear off in six to eight hours after they are ingested, but in some individuals the effects will wear off a little sooner or somewhat later (i.e., 10 to 12 hours later). Almost 100 percent of the time, all effects are gone by the evening of the flight or by the next morning. The Reduced Gravity Program has never had a researcher have a serious reaction to medication taken for C-9B flights. Some researchers have elected to take various "preventatives" on their own (antihistamines, copper bracelets, Meclizine, Dramamine, and ginger). It is **imperative** for the researcher to discuss this matter with one of the NASA physicians **prior to flight**.

1.8.2 Medical Facilities

If a medical problem arises that cannot be resolved by the medical officer assigned to the flight, other medical facilities are available in the local area. Some of these are:

1. Kelsey-Seybold Clinic (occupational/industrial facility) at JSC in building 8.

2. Christus St. John Hospital in Nassau Bay, Texas (directly across the street from JSC).

3. Clear Lake Regional Medical Center (on Texas Highway 3 between Ellington Field and JSC – about 4 miles from the airport).

In addition, there are other hospitals within 10 miles of JSC and hundreds of medical specialists in the same area.

NASA medical personnel (flight surgeons flying on the C-9B) will assist any researcher who needs additional medical care.

1.8.3 Flight Surgeon Crew Duties

On most (but not all) flights of the C-9B aircraft, a NASA flight surgeon will be aboard as a medical officer. When there is no flight surgeon aboard, consultation with one of

the NASA physicians will be quickly established via telephone. Most NASA physicians reside at JSC and may be contacted by telephone or pager. In addition, a telephone consultation may be established with one of the physicians at the Kelsey-Seybold Clinic at JSC. The clinic is open Monday through Friday between 7:30 a.m. and 5:00 p.m.

If a NASA doctor is aboard, he/she has specific duties. These include helping researchers or crew who may be ill or injured. He/she will be monitoring all researchers during the entire flight and cannot be asked to help with experiments or take photos/videos for researchers. Physicians aboard the aircraft are directly responsible for the health and safety of all concerned and take this responsibility seriously.

2.0 USER REQUIREMENTS

This section will cover topics such as how to get a test request processed, human research protocol, medical requirements, physiological requirements, badging, and funding requirements.

2.1 Test Request Procedure

Requesting flight approval is a three-step procedure:

1. Feasibility of Flying Inquiry
2. Formal Test Request (Approval Questionnaire)
3. Initial Test Request

Feasibility of Flying Inquiry

Contact the RGO to discuss the feasibility of flying an experiment, to establish tentative dates, and to answer any specific questions.

If working through one of the experiment coordinators [i.e., Glenn Research Center (GRC), Marshall Space Flight Center (MSFC) or JSC Space and Life Sciences Directorate (S&LSD)], contact them for scheduling information and specific details. This should occur at least **nine months** prior to flight.

Formal Test Request

The Formal Test Request (Approval Questionnaire) must be completed by the researcher or project manager. This must be accomplished **six months** prior to flight.

All researchers or project managers must fill out the Experiment Questionnaire prior to scheduling their experiment to fly on the C-9B. This will ensure that only valid experiments will be considered for flight. The Chief Scientist or Chief Engineer of the requesting organization must sign all questionnaires.

The Formal Test Request (Approval Questionnaire) will be sent to the RGO and to the Experiment Coordinator (if working with one). This request is valid for 2 years from the date signed.

Initial Test Request

The Initial Test Request should be submitted as soon as a flight requirement is confirmed. To ensure time constraints can be met, the request should be submitted no less than **three months** prior to the desired flight date.

One copy of an Initial Test Request should be submitted to the RGO and one copy should be sent to the Experiment Coordinator (if working with one). The Initial Test Request should contain general information describing the following:

1. Test objectives
2. Desired schedule (exact flight dates will be determined later)
3. Brief description of the test and associated test equipment
4. Number of test personnel required for flight and a description of the requirement for each individual's presence
5. Special support required or constraints, including security classification of project, if applicable
6. Preliminary Hazard Analysis identifying hazards and controls (any format is acceptable)
7. Names, addresses, and phone numbers of contacts

A representative of the JSC Institutional Review Board (IRB) will screen all initial test requests to determine if they require involvement of the JSC IRB. The researcher and the RGO will be notified of the representative's decision.

The RGO will work with the individual Experiment Coordinators to establish experiment manifests for individual flight weeks. The schedule priority is set on a first-come-first-serve basis. Experiments may be given higher priority because they have an immediate need or meet requirements to NASA. Legitimate researcher time constraints will be taken into account on a case-by-case basis.

2.2 Human Research Protocol

Researchers who plan experiments involving human test subjects, animals, or biological tests must obtain approval from the JSC IRB. See JSC-20483, JSC Institutional Review Board - Guidelines for Investigators Proposing Human Research for Space Flight and Related Investigations for details on the IRB process.

Twenty copies of a completed Human Research Master Protocol must be submitted to the JSC IRB at least **six weeks** prior to the proposed flight date. This protocol must include the equipment safety certification, which is described in the following section, and applicable signed consent forms from each subject. In addition to equipment safety certification, letter(s) of approval(s) from other IRBs and/or Institutional Animal Care Use Committees are required. All signed NASA/JSC Human Research Informed Consent forms must include a layman's summary of the experiment.

The JSC IRB meets at least once a month with additional meetings scheduled at the call of the Chair. Human Research Protocol documentation should be submitted to:

JSC Institutional Review Board
Mail Code SA
Lyndon B. Johnson Space Center
Houston, Texas 77058

Figure 1. Researchers in the Altitude Chamber

2.3 Test Personnel Requirements

This section describes requirements that must be met for a researcher to fly on the C-9B.

2.3.1 Medical Requirements

Flight personnel are classified in two categories: Category I and Category II.

Requirements for medical certification of crewmembers and human test subjects will be met by successful completion of an annual NASA flight physical.

NOTE

Failure to submit the required documentation for each person on time will preclude that person from flying.

Category I personnel (Air Force Class III Flight Physical) are:

Pilots, Astronauts, Payload Specialists, Aircraft Operations Division (AOD) Aircrew, Suited Subjects, Photographers, C-9B Test Directors, Flight Engineers, Aircraft Crew Chiefs, Medical Officers and any test subjects involved in a flight requiring Level I or Level II medical coverage as mandated by the IRB. These individuals are required to have a physical once a year.

Category I personnel must have successfully completed an Air Force Class III flight physical within the previous 12 months.

Category II personnel (C-9B Examination) are:

Pressure Suit Engineer/Technicians, Test Safety Officer, C-9B Researchers/ Investigators, Research Assistants, Test Observers, Chamber Directors/Operators/ Conductors, students involved in NASA sponsored programs, news media representatives, test subjects not involved with Level I or Level II type experiments, and any other personnel not included in the mandatory United States Air Force Class III physical category and not mentioned in this group. These individuals are required to have a physical once every three years.

All Category II personnel with a demonstrated necessity to participate in reduced gravity flight must provide the results of a C-9B Examination or equivalent Federal Aviation Administration (FAA) Third Class Aviation Physical. Guidelines are posted at http://ks.jsc.nasa.gov/zerog/ZERO-G_guide_HTSG-Med_Reqs.doc. This examination must be reported on JSC Form 8500, Report of Medical Examination, and **dated within the previous three years**. Additionally, all test personnel must meet height and weight standards set forth in the medical requirements.

The examining physician **MUST** be certified as an FAA Medical Examiner or a designated Flight Surgeon.

Costs for physical exams are the sole responsibility of the individual.

All medical questions posed by examiners should be directed to the Physiological Training Officer at (281) 792-5724. The Chief of Aircraft Operations reserves the right to refer any C-9B manifested person to the JSC Medical Office for a medical determination of a person's fitness for flight. **The Chief of the Medical Sciences Division at JSC has the final authority on whether or not a person is physically qualified to fly on the C-9B Reduced Gravity Aircraft.**

2.3.2 Physiological Training Requirements

All personnel with a demonstrated necessity to participate in reduced gravity flight must have received physiological training **within the last three years**. Physiological training will include appropriate classroom instruction and an altitude chamber hypoxia demonstration. Requirements for physiological training may be obtained from:

NASA Johnson Space Center
Physiological Training Officer
Mail Code SD27
Houston, TX 77058
Or call Mike Fox at (281) 792-5724

There is no cost for physiological training. The only costs an individual will be required to pay are travel costs to and from JSC or to a Department of Defense (DOD) (Air Force or Navy) facility.

A NASA employee must schedule individuals for physiological training. Those researchers working with an Experiment Coordinator must contact them to make arrangements for physiological training.

NASA employees will not need any additional badging for physiological training at the Sonny Carter Training Facility (SCTF). All others must meet the badging requirements documented in paragraph 2.3.5.

NOTE

Failure to submit the required documentation will preclude those individuals from flying.

2.3.3 Medical and Physiological Documentation

For individuals who have received a physical at a location other than JSC and received physiological training at a DOD (Air Force or Navy) or FAA facility, a copy of the physical examination results (JSC Form 8500) and the physiological training record for each person must be received by the Physiological Training Officer at JSC **at least four weeks prior to flight**.

Send or FAX completed physical and physiological training records to:

NASA Johnson Space Center
Physiological Training Officer
Mail Code SD27
Houston, TX 77058
Or fax to Mr. Mike Fox at (281) 792-5731 [Office phone number is (281) 792-5724

2.3.4 Security

Access to Building 993 is controlled. The building is locked after normal duty hours; however, personal valuables should not be left unattended. Researchers are responsible

for providing additional security, if required. All non-NASA badged individuals must obtain a temporary security badge prior to entering any JSC facility, including Ellington Field. Temporary badges are available from the Security Office in Building 110, on-site at JSC or with prior arrangement at Guard Post 18 at Ellington Field. See AOD 33895, Visitor's Guide NASA JSC RGO Section 2.2 for more details concerning security badging of personnel (U.S. citizens and foreign nationals).

2.3.5 Badging Requirements

All individuals who visit JSC, including Ellington Field (C-9B operations) and Sony Carter Training Facility (SCTF) (physiological training), must have a valid JSC visitors badge or NASA employee badge. This section will discuss the badging requirements.

All visitors to JSC must be sponsored by a JSC-badged employee. The Reduced Gravity Office (RGO) at JSC performs this function for most visitors to the RGO and the SCTF. If your visit to JSC is being sponsored by an office at JSC other than the RGO, you must provide the correct visitor information for both U.S. citizens and foreign nationals to that office so they can properly process your badge request paperwork.

The SCTF has become a gated facility, meaning you will have to pass through a guard gate to gain access to the parking lot at the SCTF. In order to do so, you will need to get your visitors badge (U.S. citizen or foreign national) at Building 110 (main gate) at JSC. You will also need to get a vehicle pass for the rental vehicle you are driving to the training facility.

The badging process at JSC is accomplished two ways: one method for U.S. citizens and another for foreign national visitors.

U.S. Citizens

All research personnel (flying or supporting flight operations) will be required to have the appropriate badge during their stay at JSC (Ellington Field). A NASA JSC employee must make each request for a badge. Badge requests can be made through the RGO or through the JSC office sponsoring the research.

It is the responsibility of the Experiment Coordinators (at GRC, MSFC, and JSC), the project manager, or the principle investigator to provide badge request information to the appropriate office. This information shall be provided to the appropriate JSC office **3 weeks** prior to visit. The JSC badging office requires 3 days to process a badge request. The JSC office submitting the badging request for U.S. citizens will require the following information to complete the badging request:

Name
Organization (Company/University)
Citizenship
Dates of visit
Reasons for visit

Upon arrival at JSC or Ellington Field, researchers will pick up their badge at the badging office in Building 110 at JSC. The office hours are 6:00 a.m. to 10:00 p.m. daily (including Saturday and Sunday).

For those individuals who are U. S. citizens and are going to the RGO at Ellington Field, you will be able to pick your badge up at security Post 18 at Ellington Field the morning of the first day of your visit. Prior arrangements for this must be made with the RGO.

All visitors driving vehicles that will be parked at a NASA facility will be required to have a vehicle pass. This pass can be picked up at Building 110 at JSC. You will need to have with you, your driver's license and the license plate number of your vehicle.

Permanent Resident Aliens ("Green Card")

Permanent Resident Non-U.S. citizens who have a Permanent Resident Alien Card ("green card") are treated the same as any foreign national.

Foreign Nationals

A foreign national is defined as an individual from a country other than the United States of America who is not a U. S. citizen. Additionally, U.S. citizens working for a company or corporation headquartered outside the United States will be treated as a foreign national and must also complete a JSC Form 473A (same procedure as citizens of another country). Individuals in this category are listed as "foreign representatives."

Foreign national visitors to JSC/Ellington Field must fill out JSC Form 473A. Those individuals who hold citizenship from more than one country must list all of the countries from which they hold citizenship. NASA Headquarters must approve the visit of those individuals who are citizens of a country that is listed on the "List of Designated Areas."

All Foreign Nationals must be badged according to building access. The specific areas that may be visited must be designated (i.e., Hangar 990 or Building 993, Building 276, etc.); Ellington Field alone cannot be listed. While at JSC and Ellington Field, all foreign nationals must be escorted. Foreign nationals will not have access to any NASA computer systems while on site.

The JSC office sponsoring the research or the RGO must receive the JSC Form 473A and all accompanying paperwork **8 weeks** prior to the visit.

All visitors must complete the JSC Form 473A for access to JSC. When completing the JSC Form 473A, include the following information:

The type visit: "To conduct research on NASA's C-9B Reduced Gravity Aircraft" or "attend physiological training (1) day training course."

The title of the experiment you are working on
PI's name & University
NASA Grant number
Dates of visit (your visit can only be 10 days or less)
NASA center that is managing your research
NASA Technical Manager name
Type of research (i.e., Fluid Physics, Combustion, Materials, Life Science)

In addition to JSC Form 473A, JSC requires a scanned copy of ALL foreign national paperwork including the individual's passport data page, VISA, green card, etc. Faxed copies will not be accepted. You must email the scanned copy of all foreign national paperwork, along with JSC Form 473A, to the RGO at zerog1@jsc.nasa.gov. In your email, include the reason you are requesting access to a JSC facility (i.e., planned physiological training or a planned C-9B microgravity flight).

For those individuals from countries not listed on the "List of Designated Areas," the security office at JSC will approve the visit. This process takes as much as 20 working days.

For those individuals whose country of citizenship is on the "List of Designated Areas," the request must then be sent to NASA Headquarters for final approval. Headquarters requires 60 days to process the request. Contact the RGO with any questions as to whether a researcher's country of origin is listed on the "List of Designated Areas."

When a JSC office other than the RGO sponsors the research visit, the researcher must contact the sponsoring JSC office and send the JSC Form 473A and all accompanying information to that office for processing.

All foreign nationals must report to Building 110 at JSC to pick up their badges. The Badging Office's hours of operation are 6:00 a.m. to 10:00 p.m. daily (including Saturday and Sunday). The individual must have with them a current passport, VISA, and driver's license. All foreign nationals must have a NASA escort while at JSC/Ellington Field and will not have access to any NASA computer systems.

2.3.6 Visitors

All visitors to the RGO (Building 993) shall have the appropriate visitors badge. Contact the RGO at least three weeks prior to the visit to ensure that badges will be available.

U.S. citizens will be issued Escort Required Visitor Badges during their visit.

Foreign nationals will need to follow the procedures documented in the Foreign Nationals paragraph in Section 2.3.5.

2.3.7 Mishap Form

All personnel flying on NASA aircraft must submit AOD Form 1492, Mishap Notification. This form contains the information necessary for contacting family members, or individuals of choice, in the event of an aircraft incident. All researchers must fill out the Mishap Notification Forms prior to their first flight on the C-9B. The completed forms will be kept on file in the RGO during the current flight week.

2.3.8 C-9B Safety Training

All personnel who fly on the C-9B reduced gravity aircraft must have a safety briefing at least once every six months. The briefing explains the use and operation of safety equipment located on the C-9B and how to egress the aircraft in the case of an emergency. All visitors must be informed and abide by the ground safety policies and procedures.

2.3.9 Accident and Life Insurance Notification

All manifested C-9B reduced gravity personnel must be aware that the JSC does not operate the C-9B reduced gravity aircraft as a regularly scheduled common carrier. Most life and accident insurance policies cover only persons who fly on regularly scheduled airlines and do not cover persons involved in a research aircraft accident. Therefore, some life and accident policies may not cover a C-9B reduced gravity aircraft accident. Any person manifested to board the C-9B should determine, before boarding, whether his or her life and/or accident insurance provides coverage under such conditions.

2.4 Funding

The Reduced Gravity Program is a cost-reimbursable program. All research or engineering development projects that fly on the C-9B reduced gravity aircraft must be funded by NASA through research grants, direct transfer of funds between the NASA Center conducting the research or JSC Engineering/Science Division, and the FCOD. Researchers with other U.S. government agencies must make arrangements with the RGO prior to their flight for the transfer of funds between NASA and the other U.S. government agency. Foreign government space agencies requesting flight time on the C-9B must have an MOU with NASA Headquarters prior to flight.

2.5 Timeline

This timeline has been designed to assist researchers in the timely submittal of required documentation.

Test - 9 months

Make initial inquiry about the feasibility of flying an experiment on the C-9B (see Paragraph 2.1).

Test - 6 months

Submit a Formal Test Request to an Experiment Coordinator and the RGO. Approval Questionnaires must be resubmitted every two years. (see Paragraph 2.1).

Test - 3 months

Submit Initial Test Request (see Paragraph 2.1).

Test - 6 weeks

Submit Test Equipment Data Package (see Paragraph 1.5).

Submit IRB Requirements (see Paragraph 2.2).

Submit photographic and video support and "S" Band Downlink requirements as part of Test Equipment Data Package (See AOD 33896, Test Equipment Data Package Requirement and Guidelines NASA JSC RGO).

Submit badging request for foreign nationals (JSC Form 473A - see Paragraph 2.3.5).

Submit compressed Gas (K-Bottle) requirements (breathing air, nitrogen, argon, helium - see AOD 33912, Interface Control Document NASA 932 C-9B).

Test - 4 weeks

Submit test personnel data (medical, physiological; see Paragraph 2.3.3) and names of flyers to the RGO.

Test - 3 weeks

Submit badging request for all U.S. citizens (see Paragraph 2.3.5).

Test - 4 days

Research hardware arrives at the RGO at Ellington Field.

Test - 1 day

All research hardware goes through the TRR (see Paragraph 1.6).

Test + 1 day

Arrange for shipping hardware.

Test + 1 week

Hardware must be removed from Building 993/990.

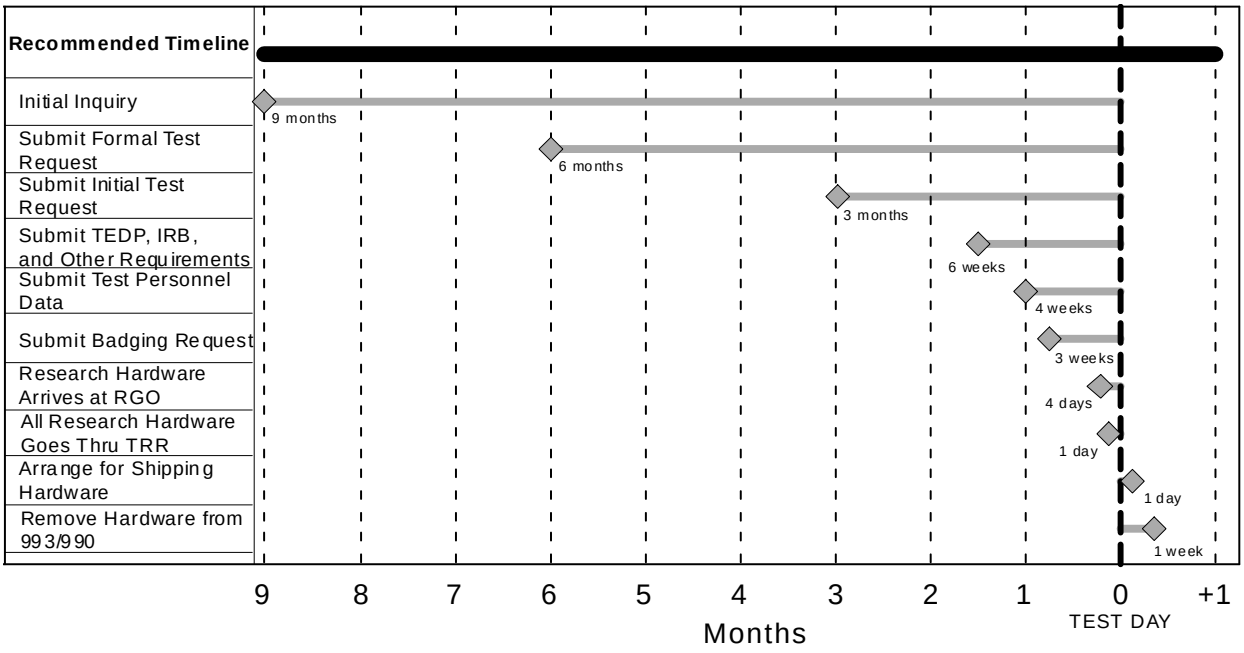

Figure 2. Submittal of Required Documentation Timeline

Figure 3. Sonoluminescence in Space (Glynn Holt – Boston University)

3.0 TEST OPERATIONS

3.1 Pre-Flight

The test equipment should be received at JSC Ellington Field in a timely manner to allow for buildup, inspection, and the TRR. The address to use for shipping is:

Reduced Gravity Office
Building 993
Ellington Field
Houston, Texas 77034

The buildup and checkout of test equipment is the sole responsibility of the researcher. All tools and checkout equipment must be provided by the researcher since the shop facilities at Ellington Field are limited.

The TRR will normally be conducted in Building 993 one working day prior to the first flight. Test equipment, personnel, procedures, and documentation will be examined as indicated in AOD 33912, Interface Control Document NASA 932 C-9B. A simulated ground run may be required during this review whereby the researcher will demonstrate normal and contingency in-flight procedures. If approved for flight by the TRR, the equipment will subsequently be loaded on the aircraft. All researcher and engineering hardware will go through a TRR every visit to the RGO. For hardware that has flown recently, a list of modifications to previously flown equipment and changes to test procedures must be provided to the RGO no later than **six weeks** prior to flight.

A preflight safety briefing prior to boarding will be given to all flight personnel who have not flown on the aircraft within the previous six months. The briefing will cover the emergency equipment on board the aircraft and the emergency egress procedures. Flight suits will be issued the morning of the first flight prior to the safety briefing. The typical preflight schedule is as follows:

8:00	Flight Suits Issued
8:15	Safety Briefing
8:45	Preflight Briefing
9:00	Board aircraft
9:30 – 11:30	Takeoff and Flight

There will be no unattended operation of research equipment on the aircraft or in Buildings 993, 994, and 990. Someone familiar with the shutdown procedures will be in attendance during any equipment operation.

3.2 In-Flight

All personnel aboard the aircraft will be under the direction of the aircraft flight crew and Test Directors, both for normal and emergency conditions and test operations. The Lead Test Director is in charge of all test activities, and the Pilot in Command is the final authority for all operations from boarding through deplaning. Strict adherence to the authority of these personnel will be rigidly enforced. Any deviation from the flight-test plan must be discussed with a Test Director before implementation. The C-9B flight crew members have formulated the following guidelines to help make research on the C-9B effective, enjoyable, and most importantly, safe.

1. Drinking water is available throughout the flight on request to the Flight Surgeon or Test Directors. It is the researcher's responsibility to make sure that the water remains contained and accounted for at all times.

2. Food is not allowed on the aircraft at any time.

3. Wear layers of clothing (i.e., typically one sweatshirt, one T-shirt, and shorts) underneath the flight suit provided by the RGO. Cotton is the best material to wear under the flight suit, as it will insulate and absorb perspiration. Tennis shoes are the preferred type of footwear. Test cabin temperatures are comfortable, but can fluctuate somewhat in-flight. Researchers should not bring their own flight suit and should not wear jewelry. Flight suits have many pockets, and should only be used to store flight essential items that have been properly inventoried.

4. Personal camcorders and cameras are generally allowed on the C-9B.

3.3 Post-Flight

A post flight debriefing will be held immediately after landing to review any problems that occurred during the flight and to discuss possible alterations to the test hardware or test procedures.

Upon completion of the flight week, the equipment will be offloaded and prepared for shipment by the researcher. It is the researcher's responsibility to ensure that all test articles and materials used in the test (including compressed gas cylinders, chemicals, packing, and crating) are removed promptly from Building 993 to make room for incoming researchers. It is also the responsibility of the researcher to make arrangements for shipment of the test equipment back to the home base of operation. Be sure to advise shippers that pickups must be made no later than 3:30 p.m., Monday through Friday only. Researchers should arrange for the shipment of their research hardware to and from Ellington Field. The address for shipping research hardware is:

Reduced Gravity Office
Building 993
Ellington Field
Houston, Texas 77034
Phone Number (281) 244-9874

Researchers should arrange for shipments to be delivered to the RGO during normal business hours (7:30 am to 4:00 pm, Monday thru Friday). Prior to the completion of a flight week, the researcher shall make the necessary arrangements for the return shipment of research hardware. The RETURN-shipping label will show the following:

Ship To: (researcher company, school, or NASA center)

Ship From: (researcher company, school, or NASA center)

NOTE

The RGO is a pickup location ONLY. It must **NOT** be named as the SHIP FROM location on any shipping documents.

Figure 4. Building 993 High-Bay Crane

On the last flight day of the week, the RGO will hand out a Customer Feedback form (JSC Form 902). Customer feedback received concerning the facilities, staff, and the Reduced Gravity Program, in general, is greatly appreciated. Customer feedback comments enable the Reduced Gravity Program to better serve its research and engineering customers.

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